REMARKS/ARGUMENTS

Claims 1 to 18 are pending in the current application. Although the Examiner indicated that some of the amendments Applicant filed on August 22, 2003 might not be acceptable, based on the remarks contained in the October 7, 2003, Office Action, the Examiner apparently entered those amendments. Accordingly, Applicant is proceeding in this communication as though the amendments to both the specification and the claims filed August 22, 2003 have been accepted.

Applicant has amended claim 11 to more specifically recite how the "centroid time" is obtained. Support for this amendment is found in the specification at page 15, lines 1 to 15. Applicant has also amended claims 12 13, 15, and 18 to replace the term "centroid time", which the Examiner finds objectionable, with the term "group velocity", thereby limiting the use of the term "centroid time" to the actual taking of data, which is more than adequately supported in the specification, as discussed below. The term group velocity is recited throughout the specification, see for example the discussion of Figure 3 on page 11 of the specification. Both of these amendments merely clarify the language of the claims and do not alter the scope or substance of the claims in any way.

Applicant had hoped that a telephonic conference could resolve many of the objections raised by the Examiner in his October 7, 2003 Office Action. However, further to the Examiner's phone call of December 2, 2003, Applicant is submitting his remarks in writing.

RESPONSE TO OBJECTION UNDER 37 CFR §1.75(d)(1)

The Examiner first objects to the amendments to the specification previously submitted in our August 22, 2003 Amendment under 37 CFR 1.75(d)(1) as introducing new matter. Specifically, the Examiner states that our amendments "introduce new matter that involves 'centroid time' nowhere found. . . ." (10/7/03 Office Action, page 2, 3rd paragraph.) Applicant strongly traverses this rejection.

Indeed, Applicant finds the Examiner's rejection puzzling in light of the explicit support for the term "centroid" in the original specification, which was referenced in our August 22, 2003 response. For example, the original specification states:

> It is found that measurements taken with the prototype track these theoretical values. The vector vacuum velocity of light was measured at an air-gap length of 220 cm. FIG. 8 shows a histogram mean value data of the tunneling time over a twenty-four hour period of measurement. The 9308 has a histogramming bin width of 1.22 ps over the 80 ns window. At L = 220 cm, the standard deviation lower bound, $\Delta\tau(\text{min})1 = \Delta X/2c$ = 507ps, requiring millions of pulser pulses to decrease the error in the tunneling time histogram mean value below a picosecond. In order to maximize the group delay time the 9307-discriminator level was set as high as possible without effecting the count rate. The tunneling direction was parallel to the Earth's surface at 108°, fixing the tunneling direction declination at -12°. A typical data set showing peak time statistic in ns for ten spectrum centroids is summarized in Table 3, below.
> (Specification, page 15, lines 1 to 15, underlining added for emphasis.)

This quotation explicitly states that the time data, shown graphically in Figure 8, and summarized in Table 3 is taken from

ten individual "centroids", which are produced by the histogramming function of the Ortec monitor. The vector velocity of light is then calculated from the time data of these centroids. Accordingly, what the discriminator is measuring in this case is the time data from the centroids, or the "centroid time".

In Applicant's amendments to the specification, and claim 1, we have merely replaced the more general term "tunneling time" with the more specific statement that the measurement is of a "centroid time" as measured from the recorded "centroids". Moreover, this terminology is more accurate as the data received from the apparatus by the Ortec monitor is actually a measurement of the "centroid" peaks, as is clearly recited in the above quotation from the specification.

Accordingly, Applicant respectfully submits that the term "centroid" is more than adequately supported by the original specification. If the Examiner maintains this rejection Applicant respectfully requests an explanation for why the above-passage does not provide adequate support for the amendment.

RESPONSE TO REJECTION UNDER 35 USC §101

The Examiner rejected claims 1 to 18 under 35 U.S.C. §101 as lacking a "specific or substantial" utility, or a "well-established" utility. Applicant respectfully traverses each of these rejections.

First, the Examiner never disputes that an apparatus capable of measuring the vector velocity of light or the

tunneling time would clearly have a "specific", "substantial", and "well-established" utility. Rather, the Examiner's principal rejection seems to be that he does not believe that the Applicant's apparatus is capable of the accuracy necessary to measure the vector velocity of light.

As an initial point, Applicant is not sure how additional proof of the operational efficacy of the invention can be provided to the Examiner. Applicant's invention is not a "theoretical" machine as is often submitted to the patent office. Instead, Applicant has actually built a working model of the inventive apparatus, a very detailed design of which is provided in the specification, and further Applicant supplies data from the apparatus which is exhaustively analyzed in the patent application from page 10 to page 15, and which clearly shows the measurement of both the vector velocity of light and the tunneling time. If the Examiner persists in questioning Applicant's data, Applicant respectfully requests a detailed explanation of the perceived deficiencies in this data.

The Examiner appears to rely heavily on the fact that one would need femtosecond accuracy to determine tunneling time. This ignores the explicit teaching of Applicant's specification, and indeed ignores one of the principal advantages of Applicant's apparatus, namely that a much simpler device can be constructed, which has the ability to measure tunneling data, using much longer wavelength transmissions. Specifically, Applicant uses radio wave transmissions, not light transmissions, to measure tunneling time. As a result, the wavelength of the transmission is much longer and the accuracy

needed to measure the tunneling time is decreased from femto to pico seconds.

For example, in the theoretical device described in the Chiao reference, which the Examiner seems to use as the "standard" for examination, the author uses .0007cm wavelength light for the transmission. Using such a short wavelength means that femtosecond measurements would be required to determine the tunneling time of the light wavefront, as clearly recited by the text of the Chiao publication. (Chiao, see Figure 4.) In contrast, our apparatus uses transmissions with wavelengths of 228cm. (Specification, page 10, lines 17 to 35.) As a result, the accuracy needed to measure the wavefront is lengthened to the picosecond regime. This advantageously allows Applicant to use a much simpler construction, which previously would have been considered impracticable.

Accordingly, Applicant respectively submits that the Examiner is using an incorrect standard upon which to judge the functionality of Applicant's device. If the Examiner maintains this rejection, Applicant respectfully requests the Examiner supply explicit evidence that would dispute Applicant's explanation of the physics behind a measurement of the tunneling time of such long wavelength transmissions, a detailed tutorial of which was previously submitted in our response dated August 22, 2003.

The Examiner also states that the "tunneling effects on the apparatus" have not been adequately addressed. Although the meaning of this objection is not particularly clear, from the context of the Examiner's other comments Applicant believes that

the Examiner is referring to the need for a "standard" measurement against which the "tunneling" measurement can be compared. Applicant respectfully traverses this rejection as well.

Applicant's device clearly records a standard or "source" signal which is directly fed into the monitor. For example, Applicant's specification states:

> The transmission source **12** signal is also monitored by the oscilloscope monitor **18** via a signal splitter **40** which is placed in signal communication with the radio-wave pulser **34**.
> (Specification, page 10, lines 4 to 6, underlining added for emphasis.)

These features are also represented in Figure 1 (see the combination of elements, 12, 18, 40, and 34), and a standard or "source" signal is graphed versus tunneling data in both Figures 6 and 7. A discussion of this data is provided in the specification, which begins, "FIGs. 6 and 7 show tunnel and source data for single data sets . . .". (Specification, page 13, line 26, underlining added for emphasis.)

In short, the specification and the data collected both provide a detailed discussion of how a comparative "standard" is to be measured and used in analyzing the tunneling data collected by the apparatus. Accordingly, if the Examiner maintains this objection in future actions Applicant respectfully requests the Examiner provide a detailed explanation of why the source data measurements collected by Applicant's apparatus would not be sufficient to "eliminate tunneling effects themselves from the time measuring apparatus."

Finally, the Examiner objects to the graphs provided in Figures 2 to 4. First the Examiner states that the "source" of the graphs remains vague. Applicant is baffled by this objection. Applicant respectfully submits that pages 9 to 12 of the specification are provided for no other reason than to detail the exact parameters used during operation of the apparatus to obtain said data, and to explain in minute detail the results obtained and the significance of those results. For example, the specification, in small part, recites:

> FIGs. 2 to 7 show the results of a typical superluminal transmission absent a signal pulse for the superluminal transmission device prototype **10** shown in FIG.1. During transmission, the source amplifier **36** gain is set at the minimum level and the FM trap is turned on. The cable lengths are adjusted such that the pulser **34** trigger pulse arrives at the oscilloscope monitor **18** just prior to the transmission wavepacket wavefronts **20**. Each transmission measurement contains 128 samples, averaged by the oscilloscope monitor **18**. The source data, or standard is taken with only the proximal barrier wall **24** in place. All error bars are the standard deviation of five data set measurements. FIG. 2 shows data from a source wavepacket measurement.
> (Specification, page 10, lines 17 to 26.)

The subsequent pages (10 to 12) then detail what the data in each of Figures 2 to 4 represent. For example, Figure 3 shows the "transmitted energy, Et(mV^2), averaged over time, $<E_t>$, from 0 to 80 ns, is shown versus air-gap length, L(cm)", and Figure 4 shows "a graph plotting the transmission fraction and tunneling time for a 204 cm wavelength verses the air-gap length."

Applicant respectfully submits that both the "source" and the significance of these results are more than adequately addressed in the specification. If the Examiner continues to require more explanation of the "source" of the graphs, Applicant requests the Examiner provide a more detailed explanation of the points of confusion raised by the data.

Also in relation to these graphs, the Examiner states that the "concept of time and energy being on the same axis" is vague. Applicant respectfully submits that graphs 3 and 4 use a very standard and well-accepted graphing technique. Specifically, as is plainly obvious from the graph two different plots are provided in each of these figures. In Figure 3, an arrow originating from the "energy", or left side of the Y-axis points to the data plot which shows energy versus air-gap length, while an arrow originating from the "time" or right side of the Y-axis points to the data plot which shows time versus air-gap length. Similar arrows on Figure 4 indicate which of the two plots graphed in that figure are to be read against the left and the right Y-axis. This graphing technique allows for the comparison of two different but related parameters in a single graph and is widely used in the physical sciences.

Again, if the Examiner maintains the objection to these graphs, Applicant requests an explanation as to why this graphing technique is inappropriate for submission in a patent application.

Under MPEP §2107.02(IV) it is well-established that the initial burden to prove a lack of utility is on the Examiner. The rejection itself must contain: "(A) An explanation that

clearly sets forth the reasoning used in concluding that the asserted utility for the claimed invention is neither both specific and substantial nor well-established; (B) Support for factual findings relied upon in reaching this conclusion; and (C) An evaluation of all relevant evidence of record, including utilities taught in the closest prior art."

Here the Examiner never questions that an apparatus capable of measuring the tunneling time of a transmission would have a "specific, substantial, and well-established" utility. Instead, the Examiner asserts that Applicant's apparatus is incapable of measuring tunneling times. For this proposition the Examiner relies on the teachings of the prior art to show that femtosecond measurements would required, despite the fact that Applicant's device explicitly teaches a different apparatus and method specifically to avoid the necessity to measure such small time increments. In addition, the Examiner completely discounts the data provided in the specification and Applicant's August 22, 2003 Amendment, both of which detail the measurement of tunneling times using Applicant's claimed apparatus.

Indeed, Applicant questions what additional evidence the Examiner would have Applicant supply to prove that the apparatus functions as claimed. In effect, any additional data would merely repeat the experiments already conducted, which show that the vector velocity of light and tunneling times are indeed measured during operation of Applicant's apparatus. Such a requirement would clearly be inappropriate. In fact, the MPEP states:

> Requests for additional evidence should be imposed rarely, and only if necessary to support the

> scientific credibility of the asserted utility . . . . As courts have stated, "it is clearly improper for the examiner to make a demand for further test data, which as evidence would be essentially redundant and would seem to serve for nothing except perhaps to unduly burden the applicant." *In re Isaacs*, 347 F.2d 887, 890, 146 USPQ 193, 196 (CCPA 1965).
> (MPEP 21076.02(V) page 2100-42, 1st column. 2nd para.)

Accordingly, Applicant requests reconsideration and withdrawal of the rejection under 35 USC §101. Absent such a withdrawal Applicant requests an explicit and specific statement from the Examiner as to why Applicant's apparatus, in light of the substantial experimental data supplied with the application, lacks utility, and what evidence if any would be sufficient to persuade the Examiner of its ability to function as described.

RESPONSE TO REJECTION UNDER 35 USC §112, 1st¶

The Examiner also rejected claims 1 to 18 under 35 U.S.C. §112, first paragraph, as lacking support given the lack of a clear utility. Applicants strongly traverse this rejection.

First, the Examiner again states that there is a "general lack of proof of the assertions behind what is being measures in 'superluminal tunneling'". Applicant has addressed this point in the above discussion in some detail, however, in summary Applicant points out that there can be no question from any reading of the specification what Applicant "claims" to measure. The specification states, "[t]he present invention is directed to a superluminal transmission device for measuring the vector velocity of light." (Specification, page 7, lines 12 to 13.) Moreover, when the transmission is directed through a quantum barrier Applicant's apparatus is able to measure a "tunneling

time", and when measurements are taken over a sufficient time period the apparatus can also function as a cosmic compass.

Because the purpose of Applicant's apparatus is clearly addressed in the specification, Applicant assumes that the Examiner is actually questioning the evidence provided to show that such a measurement can be accomplished using the inventive device. With regard to this objection, the Examiner again states that Applicant merely "asserts" that this measurement is possible. This statement is clearly in error and ignores much of the explicit disclosure provided in Applicant's specification. For example, Figures 6 and 7 show "tunnel and source data sets. . .". (Specification, page 13, line 26.) Moreover, Figure 8 shows the "daily oscillation of the tunnel time. . .". (Specification, page 14, line 6.) As previously discussed, Applicant's specification clearly teaches how to measure the vector velocity of light, how to measure a tunneling time, and how to measure the oscillation of that tunneling time.

Accordingly, Applicant can see no reason for the Examiner's continued insistence that Applicant merely "asserts" the ability to measure tunneling time. If the Examiner does not believe sufficient data or teaching is provided, Applicant requests the Examiner provide a specific explanation of why the data and related discussion would be insufficient for one of skill in the art to construct and operate Applicant's invention.

With regard to the use of Applicant's apparatus as a cosmic compass for measuring the direction of the cosmic background radiation, the Examiner also states that "many variables exist in the ideas being present that logically might apply if the

fundamental concepts were proven." First, it is unclear what the Examiner means by this statement. Based on the Examiner's May 21, 2003, Office Action, Applicant assume that this relates to the Examiner's concerns about how to account for the constant motion of the earth relative to the cosmic microwave background radiation. Applicant points out that the specification explicitly addresses this concern. For example, the specification states that:

> "Fig. 8 shows a measurement of the daily oscillation of the tunnel time, which is equivalent to the change in the vector vacuum velocity of light with tunneling direction. This tunneling direction is in turn equivalent to the cosmic background dipole direction created by the Doppler shit caused by the Earth's motion."
> (Specification, page 14 , lines 6 to 9.)

In short, the specification teaches that since the cosmic microwave background radiation has a constant direction, by taking tunneling time measurements over a single day, the rotation of the Earth will by necessity turn the instrument into the cosmic microwave background radiation blue shift direction at one point, and into the cosmic microwave background radiation red shift direction at another. In turn, by comparing the values obtained throughout the day an oscillation will be observed having a minimum and a maximum which will correspond to the red and blue shifts in the cosmic microwave background radiation. (Specification, page 14 , line 6 to page 15, line 35.) It is indeed the motion of the Earth, the solar system, and the galaxy relative to the cosmic microwave background radiation that is required to obtain the oscillation indicative of the direction of the cosmic microwave background radiation.

(A thorough discussion of the procedures necessary to ensure that the Earth's motion is properly taken into account in the measurement is provided in the specification from page 14, line 6 to page 15, line 34.)

Applicant respectfully submits that one of ordinary skill in the art having read the detailed disclosure provided would have no problem in operating Applicant's apparatus as a cosmic compass taking into account the motion of the Earth. If the Examiner persists in this rejection, Applicants respectfully requests a comprehensive list of those "variables" not sufficiently addressed by Applicant's specification.

Finally, the Examiner again raises the issue of the "effects" of tunneling on the instrument not being taken into account. Applicant is uncertain as to what "tunneling effects" the Examiner is referring to. Based on the Examiner's previous comments Applicant assumes the Examiner is again suggesting that Applicant's device does not provide a "standard" measurement against which the tunneling data can be compared. Applicant has addressed this point above with regard to the measurement of "standard" or source data during measurement. If the Examiner maintains this rejection Applicant requests a specific listing as to the sorts of "effects" the tunneling measurement might have on the apparatus that have not been adequately addressed.

Accordingly, Applicant respectfully submits that utility of the apparatus, as claimed by Applicant has been both well-established and sufficiently described by both the theoretical discussion and the actual data supplied in the filed specification, and respectfully requests withdrawal of this

grounds of rejection. If the Examiner persists with rejections under 35 U.S.C. §112, paragraph 1, on these grounds, Applicant respectfully requests that the Examiner point out with particularity why the teachings provided are not sufficient to describe the claimed apparatus.

RESPONSE TO REJECTION UNDER 35 USC §102(b)

The Examiner also maintained his rejection of claims 1 to 12 under 35 U.S.C. §102(b) or §103(a), as being either anticipated by or unpatentable over Chiao ("Tunneling Times and Superluminality: a Tutorial"). Applicant respectfully traverses these rejections as well.

Claims 1 to 10 and 13 to 16 are directed to an apparatus for measuring the tunneling time of a wavepacket comprising:

> a transmission source for generating a wavepacket, the wavepacket comprising a wavefront component;
>
> a signal controller for generating a signal pulse;
>
> a signal receiver for receiving the signal pulse;
>
> a selective-transmission device comprising a quantum barrier defining a transmission distance, said selective-transmission device being in signal communication with the transmission source, the signal controller, and the receiver such that the wavepacket is transmitted to the barrier and the wavefront component of the wavepacket tunnels through the barrier and across the transmission distance to the receiver causing superluminal group velocities; and
>
> a monitor in signal communication with the receiver for determining the centroid time for each of a plurality wavepacket peaks; and
>
> an analyzer for computing the vector group velocity of light from the measured centroid times.

In contrast, the Chiao reference merely provides an overview of the field of photon tunneling. Nowhere does Chiao, teach, describe or even suggest and apparatus, as claimed by Applicant for measuring the tunneling time of by measuring the "centroid times" of a plurality of peaks and then relating those "centroid times" to the group velocity of said wavepacket.

The Examiner rejects this distinction as not being supported by the specification. Applicants have addressed this rejection above and suggest that even were centroid times suggested by the Chiao reference, which they are not, the Chiao reference is only interested in determining the "delay" in the transmitted beam. Nowhere does Chiao teach, disclose, or even suggest constructing a device capable of measuring the vector velocity of light. Indeed, nowhere does Chiao even suggest that such a value can be calculated. Accordingly, Chiao cannot be said to anticipate every element of the claimed invention.

Although the Examiner does not explicitly rejected claims 13 to 16 over Chiao, the Examiner suggests that Chiao would inherently operate as a cosmic compass, stating "[a]ny naturally occurring Doppler shift must also effect the Chiao measurement inherently as claimed or at least would have been obvious as presented." (Office Action, page 3, point 6.) Applicants strongly disagree with this statement.

In order to operate the current invention as a cosmic compass it requires oscillation measurements and analysis that are nowhere mentioned in the Chiao reference. Moreover, the Examiner has pointed to no reference that teaches, or even suggests how one would use measurements of "centroid times" and "the vector group velocity of light" to calculate the cosmic microwave background Doppler redshift direction as required by these claims.

Accordingly, Applicants respectfully submit that in no way can Chiao be considered to anticipate the current invention. Moreover, Applicants submit that given the absence in the Chiao reference of even a suggestion of using an apparatus as described in the current application to monitor "centroid times" to obtain the vector group velocity of light, much less the direction of the cosmic microwave background Doppler redshift, that one of skill in the art would have had no motivation, nor the necessary teaching, to construct and utilize a superluminal transmission device as claimed by Applicant.

RESPONSE TO REJECTION UNDER 37 CFR §1.83

Finally, the Examiner objected to the drawings generally under 37 CFR §1.83 for not showing "every feature claimed". Applicants again traverse this rejection. All of the claimed features of the apparatus including, a transmission source, a signal controller, a signal receiver, a selective-transmission device, and a monitor and analyzer are shown in Figure 1. Moreover, the measurements required of the analyzer, and specifically the method for determining the vector group velocity from the centroid times is shown and described in Figures 2 to 8, as described above.

Applicant previously, and again, requests that if the Examiner maintains that one or more features of the claimed invention are not adequately illustrated, that he point such omitted element(s) out with particularity. The Examiner has thus far not provided any indication as to those elements omitted by the Figures, as such, Applicant is in no position to address this rejection at this time. Applicant would be happy to amend the Figures provided some indication of their deficiencies.

CONCLUSION

In view of the foregoing remarks, reconsideration and allowance of this application are respectfully requested. However, the Examiner is kindly requested to call the undersigned attorney if he should deem any claim presently in the application unpatentable.

Respectfully submitted,
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